

List of Publications MATTHIAS STEFFEN

Diploma thesis:

- [1] STEFFEN, M. (1981):
 “Atmosphärenmodell des F5-Unterriesen Procyon A”
 Diplomarbeit, Christian Albrechts Universität Kiel (in German)

Ph. D. thesis:

- [2] STEFFEN, M. (1983):
 “A Model Atmosphere Analysis of the F5 IV-V Subgiant Procyon”
 Dissertation, Christian Albrechts Universität Kiel

Habilitation thesis:

- [3] STEFFEN, M. (1992): *“Hydrodynamische Modelle konvektiver Sternatmosphären - Untersuchungen zur dynamischen und thermischen Struktur der Sonnenatmosphäre - ”*
 Habilitationsschrift, Christian Albrechts Universität Kiel

Papers published / about to be published in refereed journals:

- [4] STEFFEN, M. (1985):
 “A model atmosphere analysis of the F5 IV-V subgiant Procyon”
 Astron. Astrophys. Suppl. Ser. **59**, 403–427
- [5] HOLWEGER, H., GIGAS, D., STEFFEN, M. (1986a):
 “High-Resolution spectra of “normal” A stars: evidence for compositional differences”
 Astron. Astrophys. **155**, 58–62
- [6] HOLWEGER, H., STEFFEN, M., GIGAS, D. (1986b):
 “Compositional differences among “normal” A stars inferred from high-resolution spectroscopy”
 Astron. Astrophys. **163**, 333–336
- [7] STEFFEN, M., MUCHMORE, D. (1988):
 “Can granular fluctuations in the solar photosphere produce temperature inhomogeneities at the height of the temperature minimum?”
 Astron. Astrophys. **193**, 281–290
- [8] LIVINGSTON, W., STEFFEN, M. (1988):
 “Variability of the Spectroscopic Temperature of the Sun”
 Adv. Space Res. Vol. **8**, No. 7, 133–139, COSPAR 1988

- [9] STEFFEN, M., LUDWIG, H.-G., KRÜSS, A. (1989):
“A numerical simulation study of solar granular convection in cells of different horizontal dimension”
Astron. Astrophys. **213**, 371–382
- [10] STEFFEN, M. (1990):
“A simple method for monotonic interpolation in one dimension”
Astron. Astrophys. **239**, 443–450
- [11] LUDWIG, H.-G., JORDAN, S., STEFFEN, M. (1994):
“Numerical simulations of convection at the surface of a ZZ Ceti white dwarf”
Astron. Astrophys. **284**, 105–117
- [12] STEFFEN, M., FREYTAG, B. (1995):
“Lyapunov exponents for solar surface convection”
Chaos, Solitons & Fractals, Vol. 5, No. 10, pp. 1965–1973
(Pergamon Press)
- [13] STEFFEN, M., LUDWIG, H.-G., FREYTAG, B. (1995):
“Synthetic spectra computed from hydrodynamical model atmospheres of DA White Dwarfs”
Astron. Astrophys. **300**, 473–480
- [14] SOLANKI, S.K., RÜEDI, I., BIANDA, M., STEFFEN, M. (1996):
“On the detection of shocks in the solar granulation”
Astron. Astrophys. **308**, 623–630
- [15] FREYTAG, B., LUDWIG, H.-G., STEFFEN, M. (1996):
“Hydrodynamical models of stellar convection:
The role of overshoot in DA white dwarfs, A-type stars, and the Sun”
Astron. Astrophys. **313**, 497–516
- [16] STEFFEN, M., SZCZERBA, R., MEN'SHCHIKOV, A.,
SCHÖNBERNER, D. (1997):
“Hydrodynamical models and synthetic spectra of circumstellar dust shells around AGB stars. I. Stationary solutions”
Astron. Astrophys. Suppl. Ser. **126**, 39–65
- [17] STEFFEN, M., SZCZERBA, R., SCHÖNBERNER, D. (1998):
“Hydrodynamical models and synthetic spectra of circumstellar dust shells around AGB stars. II. Time-dependent simulations”
Astron. Astrophys. **337**, 149–177
- [18] LUDWIG, H.-G., FREYTAG, B., STEFFEN, M. (1999):
“A calibration of the mixing-length for solar-type stars based on hydrodynamical simulations”
Astron. Astrophys. **346**, 111–124

- [19] FRANCK, S., VON BLOH, W., BOUNAMA, C., STEFFEN, M., SCHÖNBERNER, D., SCHELLNHUBER, H.-J. (2000):
“Determination of Habitable Zones in Extrasolar Planetary Systems: Where are Gaia’s Sisters?”
Journal of Geophysical Research, Vol. 105, No. E1, p. 1651–1658
- [20] CORRADI, R.L.M., SCHÖNBERNER, D., STEFFEN, M., PERINOTTO, M. (2000):
“A hydrodynamical study of multiple-shell planetaries. I. NGC 2438”
Astron. Astrophys. **354**, 1071–1085
- [21] STEFFEN, M., SCHÖNBERNER, D. (2000):
“On the origin of thin detached gas shells around AGB stars. Insights from time-dependent hydrodynamical simulations”
Astron. Astrophys. **357**, 180–196
- [22] FRANCK, S., VON BLOH, W., BOUNAMA, C., STEFFEN, M., SCHÖNBERNER, D., SCHELLNHIBER, H.J. (2001):
“Limits of photosynthesis in extrasolar planetary systems for Earth-like planets”
Adv. Space Res. **28/4**, 695–700
- [23] STEFFEN, M., HOLWEGER, H. (2002):
“Line formation in convective stellar atmospheres. Granulation corrections for solar photospheric abundances”
Astron. Astrophys. **387**, 258–270
- [24] FREYTAG, B., STEFFEN, M., DORCH, B. (2002):
“Spots on the surface of Betelgeuse. Results from new 3D stellar convection models”
Astron. Nachr. **323** (2002) 3/4, 213–219
- [25] CORRADI, R.L.M., SCHÖNBERNER, D., STEFFEN, M., PERINOTTO, M. (2003):
“Ionized haloes in planetary nebulae: new discoveries, literature compilation and basic statistical properties”
Mon. Not. R. Astron. Soc. **340**, 417–446
- [26] WEDEMEYER, S., FREYTAG, B., STEFFEN, M., LUDWIG, H.-G., HOLWEGER, H. (2003):
“Numerical simulation of the three-dimensional structure and dynamics of the non-magnetic solar chromosphere”
Astron. Astrophys. **414**, 1121–1137

- [27] PERINOTTO, M., SCHÖNBERNER, D., STEFFEN, M., CALONACI, C. (2003):
*“The Evolution of Planetary Nebulae
I. A radiation hydrodynamics parameter study”*
Astron. Astrophys. **414**, 993–1015
- [28] SCHÖNBERNER, D., JACOB, R., STEFFEN, M., PERINOTTO, M., CORRADI, R.L.M., ACKER, A. (2005):
*“The Evolution of Planetary Nebulae
II. Circumstellar Environment and Expansion Properties”*
Astron. Astrophys. **431**, 963–978
- [29] SCHÖNBERNER, D., JACOB, R., STEFFEN, M. (2005):
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III. Internal kinematics and expansion parallaxes”*
Astron. Astrophys. **441**, 573–588
- [30] MONREAL-IBERO, A., ROTH, M.M., SCHÖNBERNER, D., STEFFEN, M., BÖHM, P. (2005):
“Integral Field Spectroscopy of Faint Haloes of Planetary Nebulae”
Astrophys. J. **628**, L139–L141
- [31] STRAUS, T., SEVERINO, G., STEFFEN, M. (2004):
“Are solar p-modes really asymmetric?”
ApJL (in press)

Invited contributions to books:

- [28] LIVINGSTON, W.C., DONNELLY, R.F., GRIGORYEV, V., DEMIDOV, M.L., LEAN, J., STEFFEN, M., WHITE, O.R., WILLSON, R.L. (1991):
“SUN-AS-A-STAR SPECTRUM VARIABILITY”
(“*Heights of Formation of Spectral Lines*”)
in *Solar Interior and Atmosphere*,
eds. A.N. Cox, W.C. Livingston, M.S. Matthews, p. 1109–1160
(University of Arizona Press, Tucson)
- [29] CHAN, K.L., NORDLUND, A., STEFFEN, M., STEIN, R.F. (1991):
“RECENT DEVELOPMENT IN SOLAR CONVECTION THEORY”
(“*II. Two-dimensional Numerical Simulations and Spectroscopic Properties of Solar Granules*”)
in *Solar Interior and Atmosphere*,
eds. A.N. Cox, W.C. Livingston, M.S. Matthews, p. 223–274
(University of Arizona Press, Tucson)
- [30] STEFFEN, M., JORDAN, S. (2001):
“Numerical Simulation of Stellar Convection:
Comparison with Mixing-Length Theory”
in *Encyclopedia of Astronomy and Astrophysics*,
Nature Publishing Group, p. 1894–1898
- [31] FRANCK, S., VON BLOH, W., BOUNAMA, C., STEFFEN, M., SCHÖNBERNER, D., SCHELLNHUBER, H.-J. (2002):
“Habitable Zones in Extrasolar Planetary Systems”
in *Astrobiology. The Quest for the Conditions of Life*,
eds. G. Hornbeck and C. Baumstark-Khan, Springer Verlag, p. 47-56

**Papers published / to be published in conference proceedings
(some of them refereed):**

- [32] STEFFEN, M., GIGAS, D. (1985):
“*Solar Granulation: Numerical Simulation and Resulting Disc-Center Line Profiles*”
in *Theoretical Problems in High-Resolution Solar Physics*,
ed. H. U. Schmidt, München, MPA **212**, 95–97
- [33] STEFFEN, M. (1987):
“*A 2D Study of Compressible Granular Flow and Predicted Spectroscopic Properties*”
in *The Role of Fine-Scale Magnetic Fields on the Structure of the Solar Atmosphere*, eds. E.-H. Schröter, M. Vazquez, A.A. Wyller, 47–52
(Cambridge University Press)
- [34] STEFFEN, M. (1988a):
“*Numerical Simulation of Solar Granulation: Self-consistent 2-D Models for the Quiet Sun*”
in *JOSO Annual Report 1986/87*, ed. A. v. Alvensleben, 62–69
(Kiepenheuer-Institut für Sonnenphysik, Freiburg)
- [35] STEFFEN, M. (1988b):
“*Interaction of Convection and Oscillations in the Solar Atmosphere: numerical results*”
in *Advances in Helio- and Asteroseismology*, eds. J. Christensen-Dalsgaard and S. Frandsen, 379–382 (Reidel, Dordrecht)
- [36] STEFFEN, M. (1989):
“*Spectroscopic Properties of Solar Granulation obtained from 2-D Numerical Simulations*”
in *Solar and Stellar Granulation*, eds. R.J. Rutten and G. Severino, 425–439 (Kluwer Academic Publishers)
- [37] STEFFEN, M., GIGAS, D., HOLWEGER, H., KRÜSS, A.,
LUDWIG, H.-G. (1990):
“*Results from 2-D Numerical Simulations of Solar Granules*”
in *Solar Photosphere: Structure, Convection, and Magnetic Fields*,
ed. J.O. Stenflo, 213–216, Proceedings IAU Symposium No. 138
(Kluwer, Dordrecht)
- [38] STEFFEN, M., KRÜSS, A., HOLWEGER, H. (1991):
“*Generation of Acoustic Flux Derived from Numerical Simulations of the Solar Granular Convection*”
in *Mechanisms of Chromospheric and Coronal Heating*,
eds. P. Ulmschneider, E.R. Priest, R. Rosner, 380–385 (Springer-Verlag)

- [39] STEFFEN, M. (1991):
“*2-D Radiation-Hydrodynamics Models of the Solar Photosphere*”
in *Stellar Atmospheres: Beyond Classical Models*, eds. L. Crivellari, I. Hubeny, D.G. Hummer, 247–261 (Kluwer Academic Publishers)
- [40] STEFFEN, M., FREYTAG, B. (1991):
“*Hydrodynamics of the Solar Photosphere: Model Calculations and Spectroscopic Observations*”
in *Reviews in Modern Astronomy*, Vol. 4, ed. G. Klare, 43–60 (Springer, Heidelberg)
- [41] STEFFEN, M. (1992):
“*Acoustic Flux Generation in Stellar Convection Zones: Results from Numerical Radiation Hydrodynamics Models*”
in *Stellar Chromospheres, Coronae and Winds*, eds. C.S. Jeffery and R.E.M. Griffin, Publ. Institute of Astronomy, Cambridge, p. 7–10
- [42] STEFFEN, M. (1993):
“*The Depth of the Solar Convection Zone inferred from Hydrodynamical Models of the Surface Layers*”
in *Inside the stars*, Proc. IAU Colloquium No. 137, eds. W. Weiss, A. Baglin, Astron. Soc. Pacif. Conference Series Vol. 40, p. 300–303
- [43] LUDWIG, H.-G., JORDAN, S., STEFFEN, M. (1993):
“*First Numerical Simulations of Convection at the Surface of a ZZ Ceti White Dwarf*”
in *White Dwarfs: Advances in Observation and Theory*, ed. M.A. Barstow, NATO ASI Series C, p. 471–478 (Kluwer Academic Publishers)
- [44] STEFFEN, M. (1994):
“*Acoustic flux generation in the solar convection zone*”
in *Solar magnetic fields*, eds. M. Schüssler and W. Schmidt, Cambridge University Press, p. 294–297
- [45] STEFFEN, M., FREYTAG, B., HOLWEGER, H. (1994):
“*Shocks in the solar photosphere and their spectroscopic signature*”
in *Solar magnetic fields*, eds. M. Schüssler and W. Schmidt, Cambridge University Press, p. 298–300
- [46] LUDWIG, H.-G., STEFFEN, M. (1995a):
“*Spectroscopic Effects of T-Inhomogeneities in the Atmospheres of DA White Dwarfs*”
in *White Dwarfs: Proceedings of the 9th European Workshop on White Dwarfs*, eds. D. Koester and K. Werner, Springer-Verlag, p. 128

- [47] LUDWIG, H.-G., STEFFEN, M. (1995b):
“*Hydrodynamical model atmospheres:
convection and line formation in the Sun*”
in *Stellar surface structure*, IAU Symposium No. 176, ed. K.G. Strass-
meier, Institute for Astronomy, University of Vienna, p. 235–236
- [48] FREYTAG, B., STEFFEN, M., LUDWIG, H.-G. (1995):
“*Numerical Simulations of Convection and Overshoot
in the Envelope of DA White Dwarfs*”
in *White Dwarfs: Proceedings of the 9th European Workshop on White
Dwarfs*, eds. D. Koester and K. Werner, Springer-Verlag, p. 88–92
- [49] FREYTAG, B., STEFFEN, M. (1995):
“*Numerical simulations of surface convection in solar-type stars*”
in *Stellar surface structure*, IAU Symposium No. 176, ed. K.G. Strass-
meier, Institute for Astronomy, University of Vienna, p. 111–113
- [50] LUDWIG, H.-G., FREYTAG, B., STEFFEN, M.,
WAGENHUBER, J. (1996):
“*The mixing-length parameter for solar-type convection zones inferred
from hydrodynamical models of the surface layers*”
in *Stellar Evolution: What should be done*,
Proceedings of the 32nd Liège International Astrophysical Colloquium,
eds. A. Noels et al., p. 213–217
- [51] FREYTAG, B., HOLWEGER, H., STEFFEN, M., LUDWIG, H.-G. (1997):
“*On the Scale of Photospheric Convection*”
in *Science with the VLT Interferometer*, ed. F. Paresce,
ESO Astrophysics Symposia, Springer, p. 316
- [52] LUDWIG, H.-G., FREYTAG, B., STEFFEN, M. (1997):
“*A calibration of mixing length theory based on RHD simulations
of solar-type convection*”
in *Solar Convection and Oscillations and their Relationship*,
eds. F.J. Pijpers, J. Christensen-Dalsgaard and C.S. Rosenthal,
Kluwer Academic Publishers, Dordrecht, p. 59–64
- [53] SCHÖNBERNER, D., STEFFEN, M., STAHLBERG, J., KIFONIDIS, K.,
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A Hydrodynamical Simulation*”
in *Advances in Stellar Evolution*, eds. R.T. Rood and A. Renzini,
Cambridge University Press, p. 146–153

- [54] STEFFEN, M., SZCZERBA, R., MEN'SHCHIKOV, A., SCHÖNBERNER, D. (1997):
"Time-dependent Hydrodynamical Models of Circumstellar Dust shells around Carbon- and Oxygen-rich AGB Stars"
 in *Advances in Stellar Evolution*, eds. R.T. Rood and A. Renzini, Cambridge University Press, p. 154–158
- [55] STEFFEN, M., SZCZERBA, R. (1997):
"Modeling the long-term evolution of dusty outflows of AGB-stars"
Astrophys. & Space Science 251, 131–141
 [also printed in *Dust and Molecules in Evolved Stars*, eds. I. Cherchneff and T.J. Millar, Kluwer Academic Publishers, p. 131]
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"IR-colors for models of post-AGB evolution"
Astrophys. & Space Science 251, 149–156
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"Hydrodynamical Modeling of the Evolution of Dusty Outflows from AGB-stars" in *ISO's View on Stellar Evolution*, eds. L.B.F.M. Waters, C. Waelkens and K.A. van der Hucht, P.A.Zaal, *Astrophys. & Space Science* 255, 459
 [Kluwer Academic Publishers]
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"An improved calibration of the mixing length theory based on simulations of solar-type convection"
 in *New Eyes to See inside the Sun and Stars*
 Proc. IAU Symposium No. 185, Kyoto, Japan, August 18-22, 1997
 eds. F. Deubner, J. Christensen-Dalsgaard, and D. Kurtz
 Kluwer Academic Publishers, p.???
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Space Sci. Rev. 85, 105-112

- [60] STEFFEN, M., SCHÖNBERNER, D., SZCZERBA, R. (1999):
“*Long-term evolution of AGB wind envelopes:
Insights from hydrodynamical models*”
in *Asymptotic Giant Branch Stars*, Proceedings of IAU Symposium
No. 191, Montpellier, France, August 27 - September 1 1998,
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- [61] STEFFEN, M., LUDWIG, H.-G. (1999):
“*Balmer Line Formation in Convective Stellar Atmospheres*”
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Vol. 173, p. 225
- [63] SCHÖNBERNER, D., STEFFEN, M. (1999):
“*Formation and Evolution of Planetary Nebulae*”
in *Optical and Infrared Spectroscopy of Circumstellar Matter*,
eds. E.W. Guenther, B. Stecklum & S. Klose,
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- [64] STRAUS, T., STEFFEN, M., SEVERINO, G., FREYTAG, B. (1999):
“*The Solar p-Mode Background: Observations and Hydrodynamical Models*”
in *Magnetic Fields and Solar Processes*, Proc. 9th European Meeting on
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- [65] SCHÖNBERNER, D., STEFFEN, M., STAHLBERG, J., KIFONIDIS, K.,
BLÖCKER, T. (2000): “*From the Tip of the AGB towards a Planetary:
A Hydrodynamical Simulation*”
in *The Carbon Star Phenomenon*, Proc. IAU Symposium No. 177,
ed. R.F. Wing, Kluwer Academic Publishers, p. 469–477
- [66] SCHÖNBERNER, D., STEFFEN, M. (2000):
“*On the Transition from AGB Stars to Planetary: The Spherical Case*”
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eds. J.H. Kastner, N. Soker, & S. Rappaport,
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- [68] CAYREL, R., STEFFEN, M. (2000):
“Effects of Photospheric Temperature Inhomogeneities on Lithium Abundance Determinations (2D)”
 in *The Light Elements and their Evolution*,
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 in *Post-AGB objects as a phase of stellar evolution*,
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“Evolution of thin gas shells along the AGB and beyond”
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“Spectroscopic Influence of Temperature Inhomogeneities”
 in *Highlights of Astronomy*, ed. H. Rickman,
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- [72] FRANCK, S., VON BLOH, W., BOUNAMA, C., STEFFEN, M.,
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 eds. B. Montesinos, A. Gimenez, E.F.Guinan,
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- [73] SCHÖNBERNER, D., STEFFEN, M. (2002):
*“Planetary Nebulae with Double Shells and Haloes:
 Insights from hydrodynamical models”*
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 A radiation-hydrodynamics simulation of the Planetary Nebula stage”*
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“Structure and Evolution of Planetary Nebula Haloes:”
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- [76] SCHÖNBERNER, D., STEFFEN, M. (2003):
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- [77] CORRADI, R.L.M., STEFFEN, M., SCHÖNBERNER, D.,
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- [80] WEDEMEYER, S., FREYTAG, B., STEFFEN, M., LUDWIG, H.-G., HOL-
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 Astron. Nachr. 324, No.4, p. 410-411

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